AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the above-identified application:

1. (withdrawn) A cooling tube for cooling an object, comprising:

a first end of the cooling tube in fluid communication with a second end,

wherein the cooling tube has bends along its length between the first and second ends and no plane exists where the first end, second end, and a centerline of cooling tube project onto a straight line in a plane.

2. (withdrawn) The cooling tube described in Claim 1, wherein the bends allow the cooling tube to expand and contract in response to temperature gradients.

3. (withdrawn) The cooling tube described in Claim 1, wherein the cooling tube is fabricated from a metallic material.

4. (withdrawn) The cooling tube described in Claim 1, wherein the cooling tube is fabricated from a material that is ceramic matrix composite material.

5. (withdrawn) The cooling tube described in Claim 3, wherein the ceramic matrix composite material has a woven tubular shape.

6. (withdrawn) The cooling tube described in Claim 1, wherein the cooling tube has dents to disrupt laminar flow of cooling air flowing through the cooling tube and to provide additional stress relief.

7. (withdrawn) The cooling tube described in Claim 1, wherein the cooling tube has bulges to disrupt laminar flow of cooling air flowing through the cooling tube and to provide additional stress relief.

8. (currently amended) A cooling tube for cooling a liner of a combustor chamber of a gas turbine engine, comprising:

~~The~~ a single chamber cooling tube having a first end in fluid communication with a plenum and located proximate a rear end of the combustor chamber, the plenum supplying air to the combustor chamber;

the single chamber cooling tube further having a second end in fluid communication with an area in proximity with a gas injector of the gas turbine engine and located proximate a front end of the combustor chamber; and

a centerline extending from the first end to the second end, wherein the centerline, the first end, and the second end are non-linear when projected onto a plane;

wherein the rear end of the combustor chamber and the front end of the combustor chamber are located at opposed ends of the combustor chamber for uni-directional flow of a fluid through the single chamber cooling tube, wherein the cooling tube has a serpentine shape conforming to a contour of the liner and the serpentine shape of the cooling tube allows the cooling tube to expand and contract in response to temperature gradients in the combustor chamber.

9. (currently amended) A single chamber cooling tube for cooling a liner of a combustor chamber of a gas turbine engine, the single chamber cooling tube comprising:

a first end of the single chamber cooling tube in fluid communication with a plenum supplying air to the combustor chamber, the first end located proximate a rear end of the combustor chamber;

a second end of the single chamber cooling tube in fluid communication with an area in proximity with a gas injector of the gas turbine engine, the second end located proximate a front end of the combustor chamber, the single chamber cooling tube positioned within the combustor chamber along an interior side of the liner,

wherein the exhaust end of the combustor chamber and the intake end of the combustor chamber are located at opposed ends of the combustor chamber for uni-directional flow of a fluid through the single chamber serpentine cooling tube; and

wherein the single chamber cooling tube has a serpentine shape conforming to a contour of the line and the serpentine shape of the cooling tube allows the single chamber cooling tube to expand and contract in response to temperature gradients in the combustor chamber.

10. (currently amended) The serpentine cooling tube described in Claim 8, wherein the cooling tube is positioned outside the combustor chamber along an exterior side of the liner.

11. (currently amended) A cooling tube assembly for cooling a liner of a combustor chamber of a gas turbine engine, the assembly comprising

a plurality of single chamber serpentine cooling tubes attached to the liner, each single chamber serpentine cooling tube conforming to a contour of the liner, each single chamber serpentine cooling tube including:

a first end in fluid communication with a plenum supplying air to an exhaust end of the combustor chamber, the first end located proximate the exhaust end of the combustor chamber;

a second end in fluid communication with an area in proximity with a gas injector of the gas turbine engine, the second end located proximate an intake end of the combustor chamber, wherein the exhaust end of the combustor chamber and the intake end of the combustor chamber are located at opposed ends of the combustor chamber for uni-directional flow of a fluid through each of the plurality of single chamber serpentine cooling tubes; and

a centerline extending from the first end to the second end, wherein the centerline, the first end, and the second end are non-linear when projected onto a plane.

12. (original) The cooling tube assembly described in Claim 11, wherein the cooling tube assembly is in contact with the liner.

13. (previously amended) The cooling tube assembly described in Claim 11, wherein the cooling tube assembly is maintained at a spaced distance from the liner.

14. (currently amended) A cooling tube assembly for cooling a liner of a combustor chamber of a gas turbine engine, the assembly comprising

a plurality of single chamber serpentine cooling tubes attached to the liner, each serpentine cooling tube conforming to a contour of the liner, each single chamber serpentine cooling tube having a first end in fluid communication with a plenum located proximate an exhaust end of the combustor chamber, each single chamber serpentine cooling tube having a second end in fluid communication with an area in proximity with a gas injector of the gas turbine engine located proximate an intake end of the combustor chamber, wherein the exhaust end of the combustor chamber and the intake end of the combustor chamber are located at opposed ends of the combustor chamber for uni-directional flow of a fluid through each of the plurality of single chamber serpentine cooling tubes, each single chamber serpentine cooling tube supported by a plurality of pins to maintain the serpentine cooling tube at a spaced distance from the liner and

each pin having a proximal end attached to the single chamber serpentine cooling tube and a distal end inserted through a hole in the liner, the distal end being secured from removal from the hole in a manner allowing rotational movement of the pin within the hole.

15. (currently amended) The cooling tube assembly described in Claim 14, wherein:

each single chamber serpentine cooling tube is fabricated of a metallic material; and

each proximal end is secured to the single chamber serpentine cooling tube by brazing.

16. (currently amended) The cooling tube assembly described in Claim 11, wherein the plurality of single chamber serpentine cooling tubes is positioned on an exterior side of the liner.

17. (currently amended) The cooling tube assembly described in Claim 14, wherein the plurality of <u>single chamber</u> serpentine cooling tubes is positioned on an interior side of the liner.

18. (original) The cooling tube assembly described in Claim 11, wherein the serpentine shape of each tube is formed as a plurality of alternating convex and concave bends along a length of each tube.

19. (withdrawn) A method of fabricating a cooling tube, comprising:
providing a woven tubular shape formed of ceramic matrix composite fabric;
providing a mandrel into the woven tubular shape;
densifying the CMC fabric; and
removing the expendable material.

20. (withdrawn) The method described in Claim 19, wherein the step of removing the expendable material is accomplished by heat vaporization.

20. (withdrawn) The method described in Claim 19, wherein the step of removing the expendable material is accomplished by oxidation.

22. (withdrawn) The method described in Claim 19, wherein the step of removing the expendable material is accomplished by chemical means.

23. (withdrawn) The method described in Claim 19, wherein the mandrel conforms to the configuration of a combustor line.

24. (withdrawn) The method described in Claim 19, wherein the mandrel has a serpentine shape.

25. (currently amended) A method of cooling a combustor liner, comprising:

diverting a portion of an incoming pressurized gas stream entering an intake end of the combustor to a plenum located proximate an exhaust end of the combustor;

directing the pressurized gas stream from the plenum through a plurality of single chamber serpentine cooling tubes aligned along a surface of the combustor liner, each single chamber serpentine cooling tube having a first end in fluid communication with the plenum and located proximate and exhaust end of the combustor, a second end in fluid communication with an area proximate with a fuel atomizer and located proximate the intake end of the combustor, and a centerline extending from the first end to the second end, wherein the centerline, the first end, and the second end are non-linear when projected onto a plane and wherein the exhaust end of the combustor and the intake end of the combustor are located at opposed ends of the combustor liner for uni-directional flow of a fluid through each of the plurality of single chamber serpentine cooling tubes;

allowing the pressurized gas stream flowing through the single chamber serpentine cooling tubes to absorb heat from the combustor wall to heat the pressurized gas stream to form a heated gas stream; and

providing the heated gas stream exiting the second ends to the fuel atomizer, whereby the heated gas stream aids combustion.

26. (currently amended) The method of cooling a combustor liner described in Claim 25, wherein the plurality of single chamber serpentine cooling tubes is aligned along an interior surface of the combustor liner.

27. (currently amended) The method of cooling a combustor liner described in Claim 25, wherein the plurality of single chamber serpentine cooling tubes is aligned along an exterior surface of the combustor liner.

28. (currently amended) A ~~the~~ method of cooling a combustor liner ~~described in Claim 27~~, comprising:

diverting a portion of an incoming pressurized gas stream entering an intake end of the combustor to a plenum located proximate an exhaust end of the combustor;

directing the pressurized gas stream from the plenum through a plurality of single chamber serpentine cooling tubes aligned along a surface of the combustor liner, each single chamber serpentine cooling tube ~~wherein the plurality of single chamber serpentine cooling tubes is~~ comprised of a ceramic matrix composite material and having a first end in fluid communication with the plenum and located proximate and exhaust end of the combustor, a second end in fluid communication with an area proximate with a fuel atomizer and located proximate the intake end of the combustor, and a centerline extending from the first end to the second end, wherein the centerline, the first end, and the second end are non-linear when projected onto a plane and wherein the exhaust end of the combustor and the intake end of the combustor are located at opposed ends of the combustor liner for uni-directional flow of a fluid through each of the plurality of single chamber serpentine cooling tubes;

allowing the pressurized gas stream flowing through the single chamber serpentine cooling tubes to absorb heat from the combustor wall to heat the pressurized gas stream to form a heated gas stream; and

providing the heated gas stream exiting the second ends to the fuel atomizer, whereby the heated gas stream aids combustion.

29. (currently amended) The method of cooling a combustor liner described in Claim 26,

wherein the plurality of single chamber serpentine cooling tubes is comprised of a metallic material, and

wherein each cooling tube is supported by a plurality of pins maintaining the cooling tube a spaced distance from the liner, each pin having a proximal end attached to the cooling tube and a distal end inserted through a hold in the liner, the distal end being secured from removal from the hole in a manner allowing rotational movement of the pin within the hole.